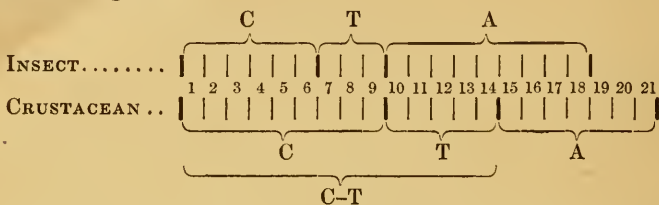


II.—On the Homologies of the Insectan and Crustacean Types. By JAMES D. DANA.

IN a note to the article on Cephalization (Annals, 1863, vol. xii.), at page 193 a brief statement is made by the writer on the relations between the structures of Insects and Crustaceans. The following diagram and explanations will make the subject more intelligible:—



The diagram presents to the eye the succession of normal segments in the two types—that of the Insect or highest Insectan, and that of the Decapod or highest Crustacean (including Crabs, Lobsters, &c.). The spaces between the vertical lines stand for the segments, which are numbered from 1 to 21. C stands for the cephalic portion or head; T, for the thorax; A, for the abdomen; C T, for the cephalothorax.

The number of normal segments in a Crustacean has been so clearly and conclusively demonstrated by Milne-Edwards that it is unnecessary to add here to what has already been said on the subject. The series and its subdivisions are illustrated in the line above, opposite CRUSTACEAN: *fourteen* segments are shown to belong to the cephalothorax, and *seven* to the abdomen. It is established beyond all doubt that each segment corresponds to a single pair of members, as follows:—number 1 to the eyes, 2, 3, to the two pairs of antennæ; then, in the *Decapod*, 4, 5, 6, 7, 8, 9, to organs of the mouth (or mandibles, maxillæ, and maxillipeds); 10, 11, 12, 13, 14, to feet; and 15–21 to the abdomen*.

The abdominal members in all Decapods which have them, and four or more posterior pairs of thoracic members or feet in degradational forms of Decapods (as in Gastrurans or the *Squilla* group and in Schizopods), are *two-branched*, or have two jointed terminations proceeding from the second segment: and this is the nearest approach in Decapods to that duplication of the

carpels of *Drimys* by their margins into one, we have exactly the ovary of *Cinnamodendron* with its sessile stigmata and five lines of placentation, as shown in pl. 24.

* In the Tetradeapod, 4, 5, 6, 7 pertain to organs of the mouth, and 8, 9, 10, 11, 12, 13, 14 to feet.

pairs of legs to each segment which occurs in the *Iuli* and some other related Myriapods*.

As the true normal limit of the head in an animal is determined by the fact that this part includes the senses, mouth, and mouth-appendages (for this is demonstrated by the principles of cephalization already explained, if not established on other grounds), the *head* in the Decapod includes *nine* segments, and the *thorax five*, although there is no constriction of the body to make the division obvious to the eye.

The relation of the Insect-type to the Decapod is at once apparent from a comparison of the two lines in the preceding diagram. Supposing the parallelism rightly presented, the following facts are to be noted :—

1. The Insect-type wants the three posterior segments of the Crustacean.

2. The head and thorax together of the Insect-type have the same number of segments (nine) as the head alone of the Decapod.

3. The head and thorax of the Insect-type contain *half* of its total number of segments (eighteen); the same of the Decapod-type contains *two-thirds* of its total (twenty-one).

4. The head of an Insect contains six segments, which is *one-third* of the total in the Insect-type; that of a Decapod nine segments, or *three-sevenths* of the total in the Crustacean type. [The head of a Tetradeapod, it may be added, contains seven, or *one-third* the total.]

5. The visceral segments (or those containing the viscera connected with digestion) are the 10th, 11th, 12th, 13th, 14th, in both the Insect-type and the Decapod-type. But in the Insect the 10th is the first behind the thorax; and in the Crustacean it is the first behind the head (or the mouth-organs)†.

* The writer has suspected that the multiplication of segments in the Phyllopods might be due to the basal part of each pair of feet becoming a separate body-segment, and that the branches corresponded to the double feet of the *Iuli*; but, as the members in these multiplicative types appear often (if not always) to have the full number of basal joints, this view does not appear to be tenable.

† Only in a degradational group of Decapods (that of the Gastrurans) do the viscera reach into the abdominal segments, or those following the 14th. The abdomen is very much elongated in these species, the cephalo-thoracic portion of the body is comparatively small, and the whole structure is lax and low in grade. The species thus stand apart from the Macrurans as a separate tribe, equivalent to those of Brachyurans and Macrurans, while the Schizopods are only degradational Macrurans. See 'Annals,' *l. c.* In the fact that the viscera of the Squilloids or Gastrurans are contained in the *abdominal* portion of the animal, this group appears to approach the order of Insects. But this seeming approximation comes, as observed, through degradation, and is analogous to that between a *Limulus* and an Insect, as explained on page 193.

The last two or three normal segments in Insects (that is, the 16th, 17th, and 18th) are frequently wanting.

In the above homological comparisons it is assumed that the three anterior normal segments present in a Crustacean are normally and potentially present in an Insect. This will be considered by many as the doubtful point in the above comparisons. But it is proved to be correct by the fact that these three segments are sense-bearing segments in Crustaceans, and the Insect fails in no sense belonging to the Crab. As stated on page 188 (*Annals*, *l. c.*), the absence of a jointed organ is no proof of the absence of the segments, unless it be true also that the corresponding sense is wanting.

If the constitution of the anterior part of the head in the Insect be still questioned, there is nevertheless good reason for making the mandibular segment in the Articulate type (as it adjoins the centre in embryonic development, from which progress goes on forward and backward) normally identical in all groups under that type; and hence from this segment, or No. 4 in the Crustacean series, on to No. 18, the parallelism between the Insect and Crustacean must be rightly given; consequently, if there is any doubt, it holds only with regard to Nos. 1, 2, and 3. The law of unity of structure under a type seems, however, to preclude even this chance for doubt.

Comparing the higher Decapods among Crustaceans and the higher Insects, the mean size or mass is about as 50 to 1. This ratio indicates approximately the amount of condensation in the Articulate structure connected with the elevation of grade from the typical Crustacean to the typical Insectean.

III.—*On Freshwater Rhizopoda of England and India; with Illustrations.* By H. J. CARTER, F.R.S. &c.

[Plates I. & II.]

THE object of this communication is to bring together descriptions and illustrations of the freshwater Rhizopoda which I have found in England since my return from India in 1862, and also to add some of those which from time to time came under my notice in the island of Bombay, in order that I may, to a certain extent, show what species are common to both localities, and also some of those which may be peculiar to Bombay, or at least may not yet have been described.

Further, I have drawn most of these on the same scale, and have added some of their varieties respectively, so that an idea may be thus gained of their sizes generally, as well as of some of their differences in point of shape; for, unless they are treated